Instructions-Parts

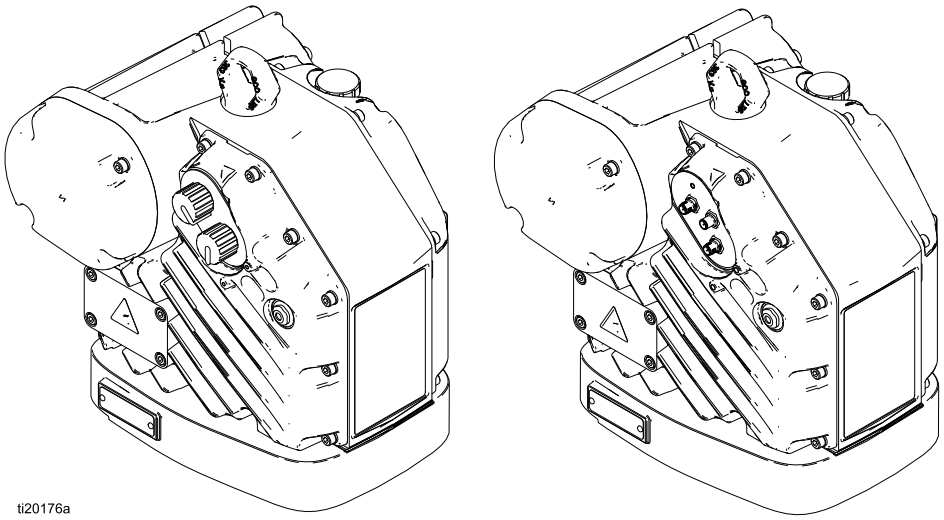
E-Flo® DC Motor

3A2526F
EN

Electric drive for low to medium volume paint circulation pumps.
For professional use only.

Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.

See page 3 for model part numbers and approvals information.



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Models

Basic Models

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0011	A	1	1400 (6227)
EM0021	A	2	2800 (12455)

CE 0359

Ex II 2 G
Ex db IIA T6 0°C≤Ta≤40°C
FM12ATEX0067X
IECEx FMG 12.0028X

FM C US APPROVED For Class I, Div. 1, Group D T6.
Class 1, Zone 1, AEx db IIA T6 0°C≤Ta≤40°C
Ex d IIA T6 Gb 0°C≤Ta≤40°C

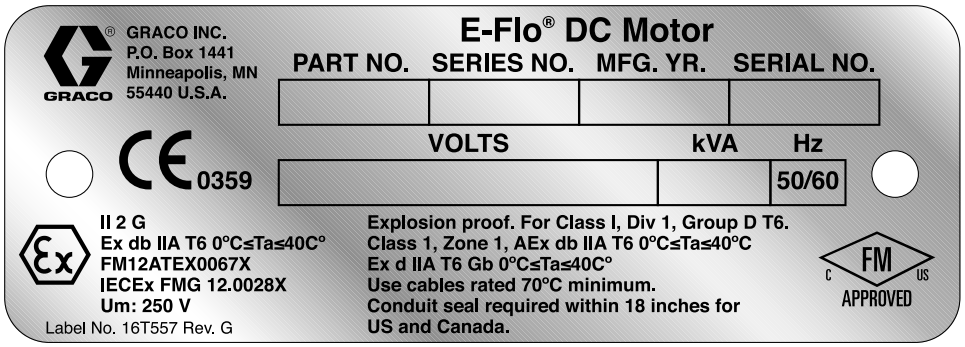


Figure 1 Basic Motor Identification Label

List of Standards

- IEC 60079–0: 2011 (Ed. 6)
- IEC 60079–1: 2007 w/Corr 1 (Ed 6)
- EN 60079–0: 2012
- EN 60079–1: 2007
- ANSI/ISA 60079–0: 2009
- ANSI/ISA 60079–1: 2009
- FM 3615:2006
- CSA C22.2 No. 0.4:2004 (R2009)
- CSA C22.2 No. 0.5:82 (R2008)
- CSA C22.2 No. 30:M86 (R2007)
- CAN/CSA-E60079–0:2011
- CAN/CSA-E60079–1:2011
- CAN/CSA C22.2 No. 1010.1:2004

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Basic Models with Region-Specific Approvals

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0013	A	1	1400 (6227)
EM0023	A	2	2800 (12455)

CE 0359

Ex II 2 G
Ex d IIA T6 0°C≤Ta≤40°C
FM12ATEX0067X
IECEx FMG 12.0028X

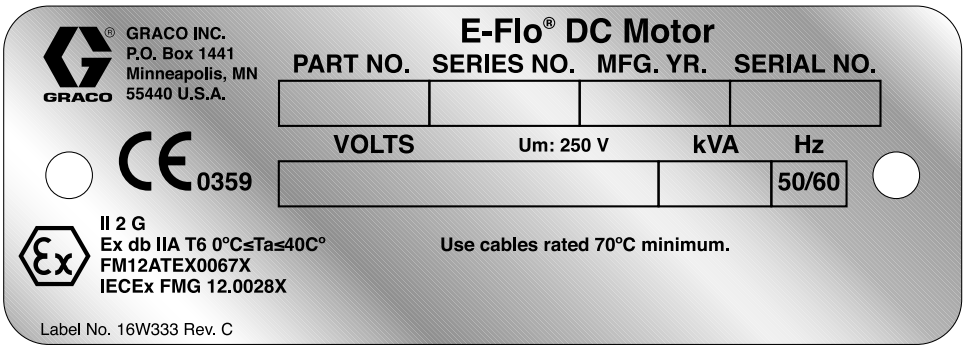


Figure 2 Basic Motor with Region-Specific Approvals Identification Label

List of Standards

- IEC 60079–0: 2011 (Ed. 6)
- IEC 60079–1: 2007 w/Corr 1 (Ed 6)
- EN 60079–0: 2012
- EN 60079–1: 2007

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Advanced Models

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0012	A	1	1400 (6227)
EM0022	A	2	2800 (12455)
EM0025	A	2	2800 (12455)

CE 0359

Ex II 2 (1) G
Ex db [ia] IIA T6 0°C≤Ta≤40°C
FM12ATEX0067X
IECEx FMG 12.0028X

FM C US APPROVED For Class I, Div. 1, Group D T6.
Class 1, Zone 1, AEx db [ia] IIA T6 0°C≤Ta≤40°C
Ex db [ia] IIA T6 0°C≤Ta≤40°C

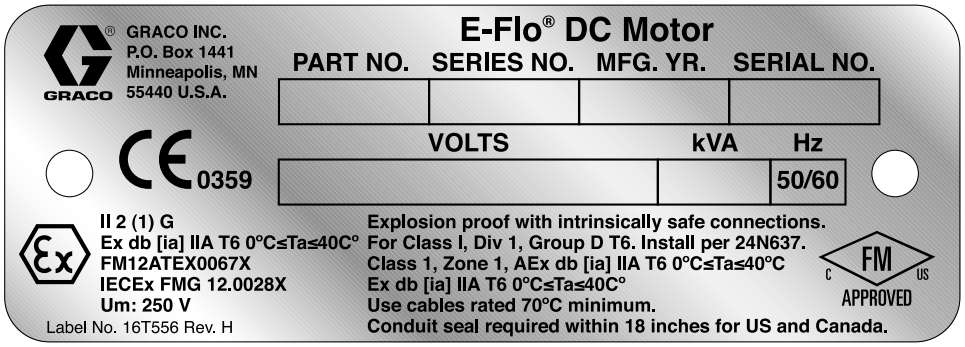


Figure 3 Advanced Motor Identification Label

List of Standards

- IEC 60079–0: 2011 (Ed. 6)
- IEC 60079–1: 2007 w/Corr 1 (Ed. 6)
- IEC 60079–11: 2011 (Ed. 6)
- EN 60079–0: 2012
- EN 60079–1: 2007
- EN 60079–11: 2012
- FM 3600:2011
- FM 3610:2010
- FM 3615:2006
- FM 3810:2005
- CSA C22.2 No. 0.4:2004 (R2009)
- CSA C22.2 No. 0.5:82 (R2008)
- CSA C22.2 No. 30:M86 (R2007)
- CSA C22.2 No. 157–92 (R2006)
- CAN/CSA-E60079–0:2011
- CAN/CSA-E60079–1:2011
- CAN/CSA C22.2 No. 1010.1:2004
- CAN/CSA-E60079–11:2011
- ANSI/ISA 60079–0:2009
- ANSI/ISA 60079–1:2009
- ANSI/ISA 60079–11:2011

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Advanced Models with Region-Specific Approvals

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0014	A	1	1400 (6227)
EM0024	A	2	2800 (12455)
EM0026	A	2	2800 (12455)

CE 0359

Ex II 2 (1) G
Ex d [ia] IIA T6 0°C≤Ta≤40°C
FM12ATEX0067X
IECEx FMG 12.0028X

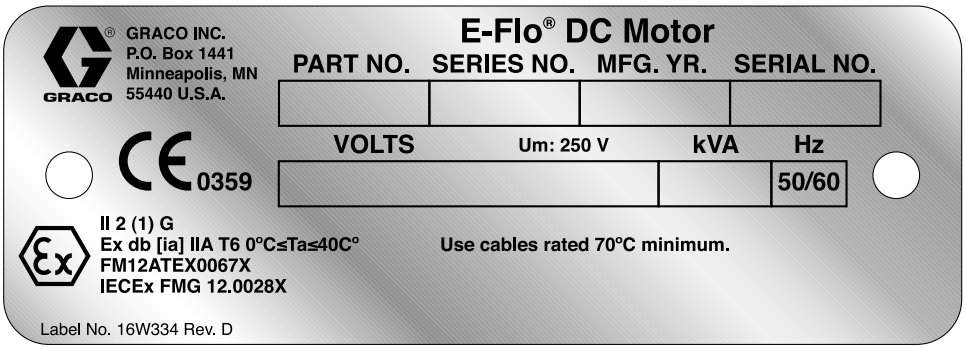


Figure 4 Advanced Motor with Region-Specific Approvals Identification Label

List of Standards

- IEC 60079–0: 2011 (Ed. 6)
- IEC 60079–1: 2007 w/Corr 1 (Ed. 6)
- IEC 60079–11: 2011 (Ed. 6)
- EN 60079–0: 2012
- EN 60079–1: 2007
- EN 60079–11: 2012

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Flammable fumes, such as solvent and paint fumes, in **work area** can ignite or explode. To help prevent fire and explosion:

- Use equipment only in well ventilated area.
- Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc).
- Keep work area free of debris, including solvent, rags and gasoline.
- Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.
- Ground all equipment in the work area. See **Grounding** instructions.
- Use only grounded hoses.
- Hold gun firmly to side of grounded pail when triggering into pail. Do not use pail liners unless they are antistatic or conductive.
- **Stop operation immediately** if static sparking occurs or you feel a shock, Do not use equipment until you identify and correct the problem.
- Keep a working fire extinguisher in the work area.

Static charge may build up on plastic parts during cleaning and could discharge and ignite flammable vapors. To help prevent fire and explosion:

- Clean plastic parts only in well ventilated area.
- Do not clean with a dry cloth.
- Do not operate electrostatic guns in equipment work area.

SPECIAL CONDITIONS FOR SAFE USE

- To prevent the risk of electrostatic sparking, the equipment's non-metallic parts should be cleaned only with a damp cloth.
- The aluminum housing may spark upon impact or contact with moving parts, which may cause fire or explosion. Take precautions to avoid such impact or contact.
- All flameproof joints are critical to the integrity of the motor as approved for hazardous locations and are not repairable if damaged. Damaged parts must be replaced only with genuine Graco parts with no substitutions.

WARNING

ELECTRIC SHOCK HAZARD

This equipment must be grounded. Improper grounding, setup, or usage of the system can cause electric shock.

- Turn off and disconnect power at main switch before disconnecting any cables and before servicing or installing equipment.
- Connect only to grounded power source.
- All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.

INTRINSIC SAFETY

Intrinsically safe equipment that is installed improperly or connected to non-intrinsically safe equipment will create a hazardous condition and can cause fire, explosion, or electric shock. Follow local regulations and the following safety requirements.

- Be sure your installation complies with national, state, and local codes for the installation of electrical apparatus in a Class I, Group D, Division 1 Hazardous Location, including all of the local safety fire codes, NFPA 33, NEC 500 and 516, and OSHA 1910.107.
- Equipment that comes in contact with the equipment's intrinsically safe terminals must meet the entity parameter requirements specified in Control Drawing 24N637. See Intrinsically Safe Installation Requirements for Advanced Motors, page 12. This includes safety barriers, DC voltage meters, ohmmeters, cables, and connections. Remove the unit from the hazardous area when troubleshooting.
- Do not install any equipment approved only for a non-hazardous location in a hazardous area, as defined in Article 500 of the National Electrical Code (USA) or your local electrical code. See the ID label for the intrinsic safety rating for your equipment.
- Ground the motor. Use a 12 gauge minimum ground wire, connected to a true earth ground. See Grounding, page 12.
- Do not operate the motor with any cover removed.
- Do not substitute system components, as this may impair intrinsic safety.

BURN HAZARD

Equipment surfaces and fluid that's heated can become very hot during operation. To avoid severe burns:

- Do not touch hot fluid or equipment.

MOVING PARTS HAZARD

Moving parts can pinch, cut or amputate fingers and other body parts.

- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the **Pressure Relief Procedure** and disconnect all power sources.

⚠ WARNING

PRESSURIZED EQUIPMENT HAZARD

Fluid from the equipment, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.

- Follow the **Pressure Relief Procedure** when you stop spraying/dispensing and before cleaning, checking, or servicing equipment.
- Tighten all fluid connections before operating the equipment.
- Check hoses, tubes, and couplings daily. Replace worn or damaged parts immediately.

TOXIC FLUID OR FUMES

Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.

- Read MSDSs to know the specific hazards of the fluids you are using.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.

PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. This equipment includes but is not limited to:

- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Data** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS from distributor or retailer.
- Do not leave the work area while equipment is energized or under pressure.
- Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.

Installation

Installation of this equipment involves potentially hazardous procedures. Only trained and qualified personnel who have read and who understand the information in this manual should install this equipment.

NOTE: To install an advanced motor, also see Intrinsically Safe Installation Requirements for Advanced Motors, page 12.

Fill With Oil Before Using Equipment

Before using the equipment, open the fill cap (P) and add Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil. Check the oil level in the sight glass (K). Fill until the oil level is near the halfway point of the sight glass. The oil capacity is approximately 1.5 quarts (1.4 liters). **Do not overfill.**

NOTE: Two 1 quart (0.95 liter) bottles of oil are supplied with the equipment.

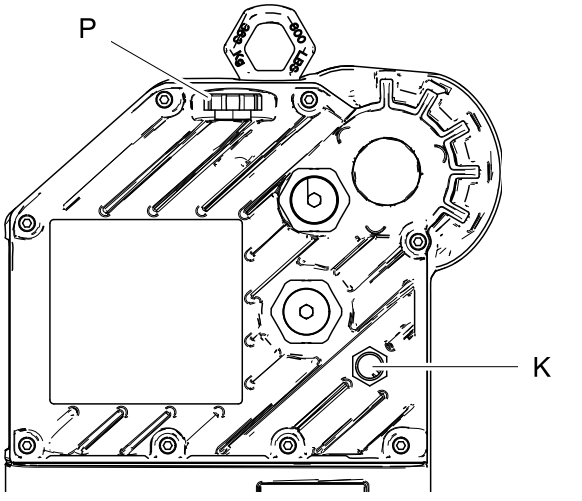


Figure 5 Sightglass and Oil Fill Cap

Power Supply Requirements

Improper wiring may cause electric shock or other serious injury if work is not performed properly. Have a qualified electrician perform any electrical work. Be sure your installation complies with all National, State and Local safety and fire codes.

See Table 1 for power supply requirements. The system requires a dedicated circuit protected with a circuit breaker.

Table 1 . Power Supply Specifications

Model*	Voltage	Phase	Hz	kVA
EM001x	100–130 /200–240 Vac	1	50/60	1.4
EM002x	200–240 Vac	1	50/60	2.9

* The last digit of the Model No. varies. See the **Models** tables on pages 3–6.

Hazardous Area Cabling and Conduit Requirements

Explosion Proof

All electrical wiring in the hazardous area must be encased in Class I, Division I, Group D approved explosion-proof conduit. Follow all National, State, and Local electric codes.

A conduit seal (D) is required within 18 in. (457 mm) of the motor for the US and Canada.

All cables must be rated at 70°C.

Flame Proof (ATEX)

Use appropriate conduit, connectors, and cable glands rated for ATEX II 2 G. Follow all National, State, and Local electric codes.

All cable glands and cables must be rated at 70°C.

Connect the Power Supply

Improper wiring may cause electric shock or other serious injury if work is not performed properly. Have a qualified electrician perform any electrical work. Be sure your installation complies with all National, State and Local safety and fire codes.

1. Ensure that the fused safety switch (B) is shut off and locked out.

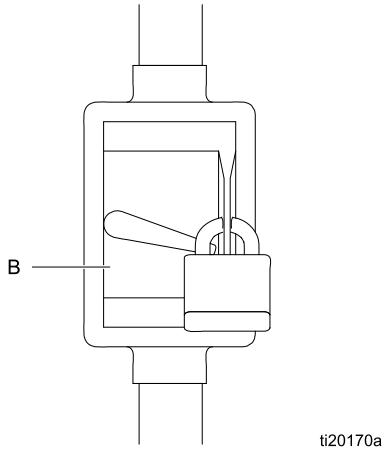


Figure 6 Locked Out Fused Safety Switch

2. Install a start/stop control (C) in the electrical supply line (A), within easy reach of the equipment. The start/stop control must be approved for use in hazardous locations.
3. Open the electrical compartment (S) on the motor.
4. Bring the power wires into the electrical compartment through the 3/4–14 npt(f) inlet port. Connect the wires to the terminals, as shown. Torque the terminal nuts to 25 in-lb (2.8 N•m) maximum. **Do not over-torque.**
5. Close the electrical compartment. Torque the cover screws (J) to 15 ft-lb (20.3 N•m).

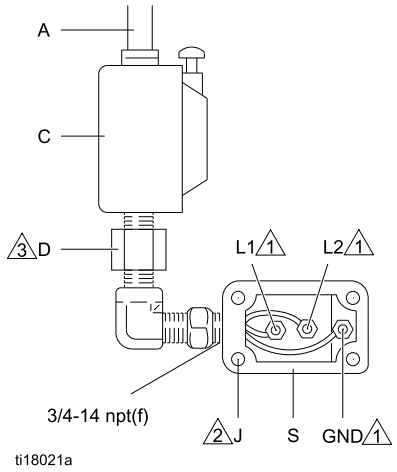


Figure 7 Connect the Power Wires

Notes for Fig. 7	
1	Tighten all terminal nuts to 25 in-lb (2.8 N•m) maximum. **Do not over-torque.**
2	Tighten cover screws to 15 ft-lb (20.3 N•m).
3	A conduit seal (D) is required within 18 in. (457 mm) of the motor for the US and Canada.

Grounding

This equipment must be grounded to reduce the risk of static sparking and electric shock. Electric or static sparking can cause fumes to ignite or explode. Improper grounding can cause electric shock. Grounding provides an escape wire for the electric current.

NOTE: For advanced motors EM0012 and EM0022, all motors must be bonded to the same high integrity equipotential system. See Intrinsically Safe Installation Requirements for Advanced Motors, page 12.

Loosen the ground screw and attach a ground wire (Y). Tighten the ground screw securely. Connect the other end of the ground wire to a true earth ground.

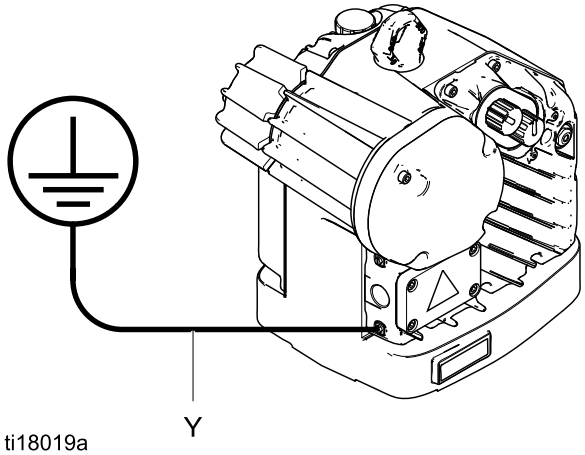


Figure 8 Ground Wire

Intrinsically Safe Installation Requirements for Advanced Motors

Do not substitute or modify system components as this may impair intrinsic safety. For installation, maintenance, or operation instructions, read instruction manuals. Do not install equipment approved only for non-hazardous location in a hazardous location. See the identification label for the intrinsic safety rating for your model.

See Appendix A - System Control Drawing 24N637, page 37, for installation requirements and entity parameters. Follow all installation instructions in your system manual.

Operation

Startup

1. Unlock the fused safety switch (B) and turn it on. See Connect the Power Supply, page 11
2. Press the start pushbutton (C).
3. Check that the power indicator (L) is lit (steady on).
4. See Advanced Motor Operation, page 13 or Basic Motor Operation, page 14 for further instructions.

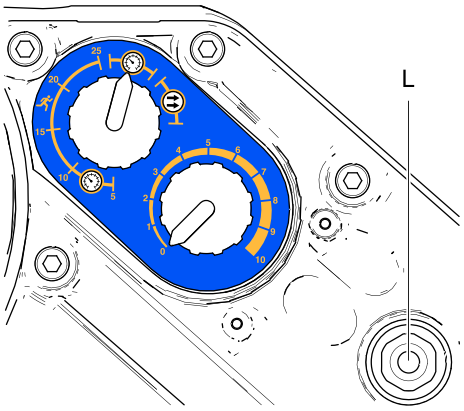


Figure 9 Power Indicator

Shutdown

Follow the Pressure Relief Procedure, page 13.

Pressure Relief Procedure

This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop spraying and before cleaning, checking, or servicing the equipment.

1. Disengage the start/stop control (C). See Connect the Power Supply, page 11
2. Shut off and lock out the fused safety switch (B).
3. Relieve all fluid pressure as explained in your separate E-Flo DC pump manual.

Advanced Motor Operation

The Advanced E-Flo DC motors require installation of the 24P822 Control Module Accessory Kit to provide the interface for users to enter selections and view information related to setup and operation. See the Control Module Accessory Kit manual for installation and operation information.

NOTICE

To prevent damage to the softkey buttons, do not press the buttons with sharp objects such as pens, plastic cards, or fingernails.

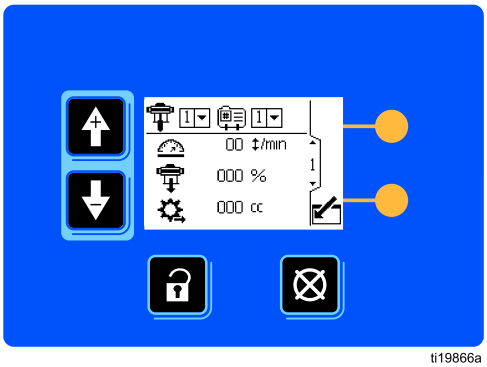


Figure 10 Control Module Accessory

Basic Motor Operation

The basic motor has three operating modes:

- Pressure Mode
- Pressure Mode with Integrated Runaway Protection
- Flow Mode

NOTE: Before changing from one mode to another, turn the Control Knob (N) fully counterclockwise to 0.

Pressure Mode

When in pressure mode, the motor will adjust the speed to maintain a constant fluid pressure.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. Turn the switch to Pressure. Push the switch in to lock.
3. Pull the Control Knob (N) out to set. Turn the knob clockwise to increase the pressure, or counterclockwise to decrease the pressure. Push the knob in to lock.

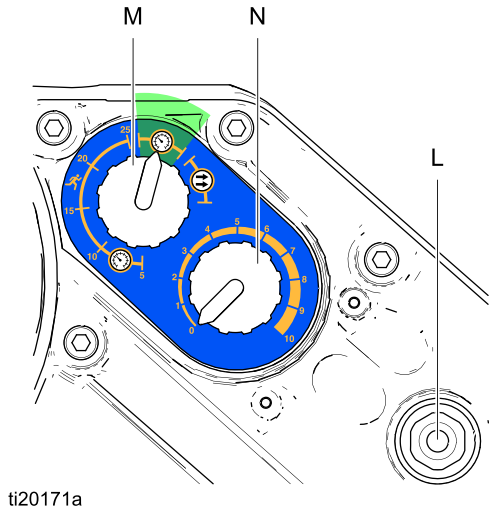


Figure 11 Pressure Mode

Pressure Mode with Integrated Runaway Protection

In pressure mode with integrated runaway protection, the motor will adjust the speed to maintain a constant fluid pressure, but will shut down if it exceeds a user-set speed.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. In the Runaway range, turn the switch to the desired shutdown speed in cycles per minute (5, 10, 15, 20, or 25). Push the switch in to lock.
3. Pull the Control Knob (N) out to set. Turn the knob clockwise to increase the pressure, or counterclockwise to decrease the pressure. Push the knob in to lock.

NOTE: The motor will shut down if the selected speed is exceeded for 5 cycles. To reset, turn the Control Knob (N) fully counterclockwise to 0, then turn to the desired pressure.

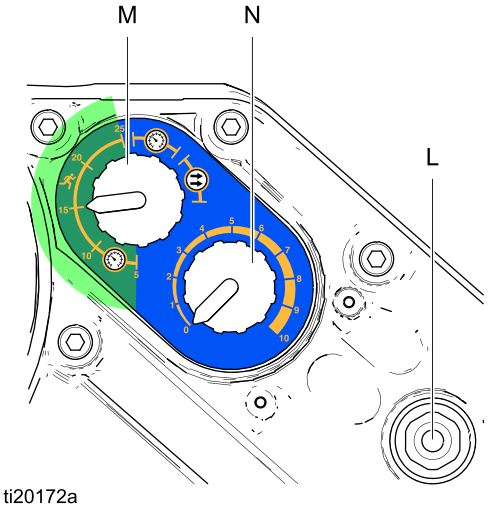


Figure 12 Pressure Mode with Integrated Runaway Protection

Flow Mode

When in flow mode, the motor will maintain a constant speed regardless of the fluid pressure, up to the pump's maximum working pressure. See Technical Data, page 43.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. Turn the switch to Flow . Push the switch in to lock.
3. The amount of flow is determined by the cycle rate set with the Control Knob (N). The knob's scale (0–10) corresponds to a cycle adjustment range of 0-30 cycles per minute. Turn the Control Knob (N) clockwise to increase the cycle rate (flow), or counterclockwise to decrease the cycle rate (flow).

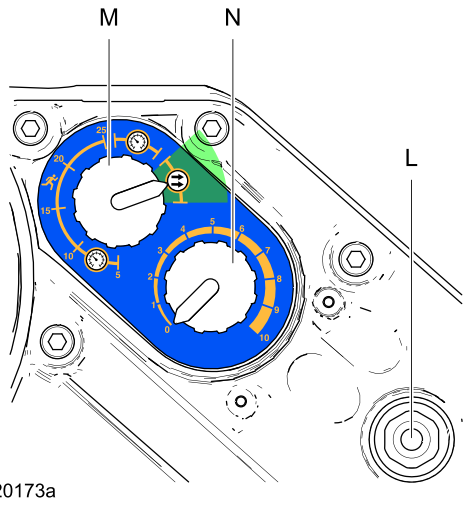


Figure 13 Flow Mode

Maintenance

Preventive Maintenance Schedule

The operating conditions of your particular system determine how often maintenance is required. Establish a preventive maintenance schedule by recording when and what kind of maintenance is needed, and then determine a regular schedule for checking your system.

Change the Oil

NOTE: Change the oil after a break-in period of 200,000–300,000 cycles. After the break-in period, change the oil once a year. Order two Part No. 16W645 ISO 220 silicone-free synthetic gear oil.

1. Place a minimum 2 quart (1.9 liter) container under the oil drain port. Remove the oil drain plug (25). Allow all oil to drain from the motor.
2. Reinstall the oil drain plug (25). Torque to 25–30 ft-lb (34–40 N•m).
3. Open the fill cap (P) and add Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil. Check the oil level in the sight glass (K). Fill until the oil level is near the halfway point of the sight glass. The oil capacity is approximately 1.5 quarts (1.4 liters). **Do not overfill.**
4. Reinstall the fill cap.

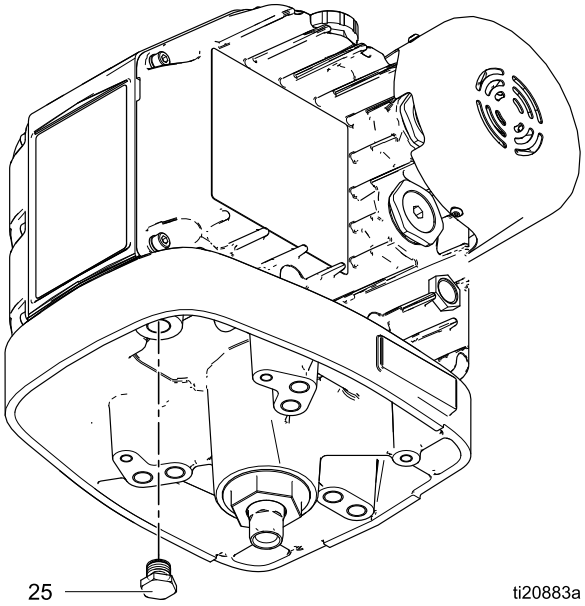


Figure 14 Oil Drain Plug

Check Oil Level

Check the oil level in the sight glass (K). The oil level should be near the halfway point of the sight glass when the unit is not running. If low, open the fill cap (P) and add Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil as required. The oil capacity is approximately 1.5 quarts (1.4 liters). **Do not overfill.**

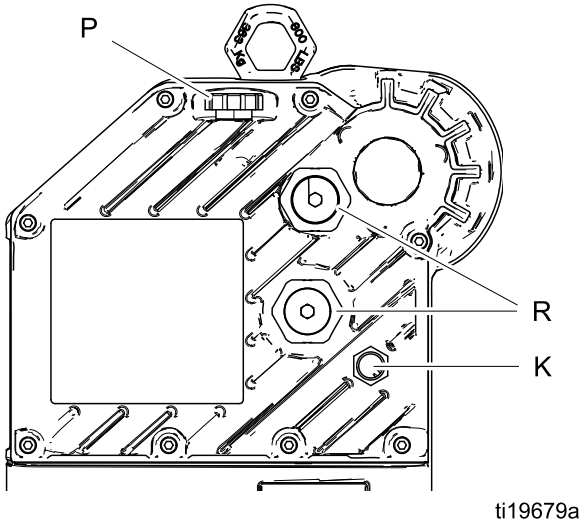


Figure 15 Sightglass and Oil Fill Cap

Bearing Pre-Load

The bearing pre-loads (R) are factory set and are not user adjustable. Do not adjust the bearing pre-loads.

Error Code Troubleshooting

Error codes can take three forms:

- Alarm : alerts you to the alarm cause and shuts down the pump.
- Deviation : alerts you to the problem, but pump may continue to run past the set limits until the system's absolute limits are reached.
- Advisory: information only. Pump will continue to operate.

NOTE: On Advanced motors, flow (K codes) and pressure (P codes) can be designated as alarms or deviations. See **Setup Screen 4** in the Control Module Manual.

NOTE: In the error codes listed below, an "X" means the code is associated with the display only.

NOTE: In the error codes listed below, a "?" in the code is a placeholder for the unit number where the event occurred.

NOTE: The blink code is displayed using the power indicator on the motor. The blink code given below indicates the sequence. For example, blink code 1–2 indicates 1 blink, then 2 blinks; the sequence then repeats.

NOTE: A blink code of 9 is not an error code, but an indicator of which pump is active (softkey has been pushed, see **Run Screen 1** in the Control Module Manual).

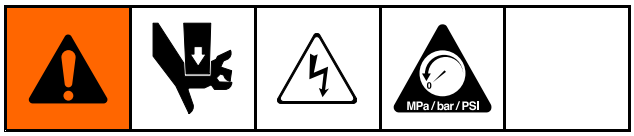
Applicable Motor	Blink Code	Display Code	Alarm or Deviation	Description
Advanced	1–2	K1D?	Alarm	Flow is below minimum limit.
Advanced	None	K2D?	Deviation	Flow is below minimum limit.
Basic and Advanced	1	K4D?	Alarm	Flow exceeds maximum target; also indicates pump runaway condition exists.
Advanced	None	K3D?	Deviation	Flow exceeds maximum target; also indicates pump runaway condition exists.
Advanced	1–3	P1I?	Alarm	Pressure is below minimum limit.
Advanced	None	P2I?	Deviation	Pressure is below minimum limit.
Advanced	1–4	P4I?	Alarm	Pressure exceeds maximum target.
Advanced	None	P3I?	Deviation	Pressure exceeds maximum target.
Basic and Advanced	2	V1I?	Alarm	Brown out; voltage supplied to motor is too low.
Basic and Advanced	3	V4I?	Alarm	Voltage supplied to motor is too high.
Advanced	2–3	CAD?	Alarm	Unit detects a loss of CAN communication. This alarm is only logged. No flashing alarm appears on the display, but the blink code does occur.
Advanced	None	CAC?	Alarm	Display detects a loss of CAN communication. Flashing alarm appears on the display, and the blink code occurs.

CONTINUED ON THE NEXT PAGE.

Applicable Motor	Blink Code	Display Code	Alarm or Deviation	Description
Advanced	2–4	CAG?	Alarm	Display detects a loss of modbus communication when control access is set to modbus.
Basic and Advanced	4	WXD?	Alarm	An internal control board hardware failure is detected.
Advanced	1–5	WSD?	Alarm	Invalid lower size; occurs if the unit is operated before setting up the lower size.
Basic and Advanced	5	T3D?	Deviation	Over temperature.
Advanced	None	P5DX	Deviation	More than one pump is assigned to a transducer. The assignment for that transducer is automatically cleared under this condition. User must reassign.
Advanced	None	P6CA or P6CB	Deviation	For units without closed loop pressure control: Transducer (A or B) is enabled but not detected.
Advanced	1–6	P6D?	Alarm	For units with closed loop pressure control: Transducer is enabled but not detected.
Advanced	None	MND?	Advisory	Maintenance counter is enabled and countdown reached zero (0).
Basic	6	None	Alarm	The Mode Select knob is set between Pressure and Flow . Set knob to the desired mode.
Basic and Advanced	2–6	V1M?	Alarm	AC power is lost.
Basic and Advanced	3–5	T2D?	Alarm	Internal thermistor disconnected.
Basic and Advanced	3–4	WNC?	Alarm	Software versions do not match.
Basic and Advanced	3–6	CCN?	Alarm	Circuit board communication failure.
Basic and Advanced	4–5	WMC?	Alarm	Internal software error.
Basic and Advanced	9	None	None	A blink code of 9 is not an error code, but an indicator of which pump is active (see **NOTE** above).

Repair

Replace Output Seal Cartridge

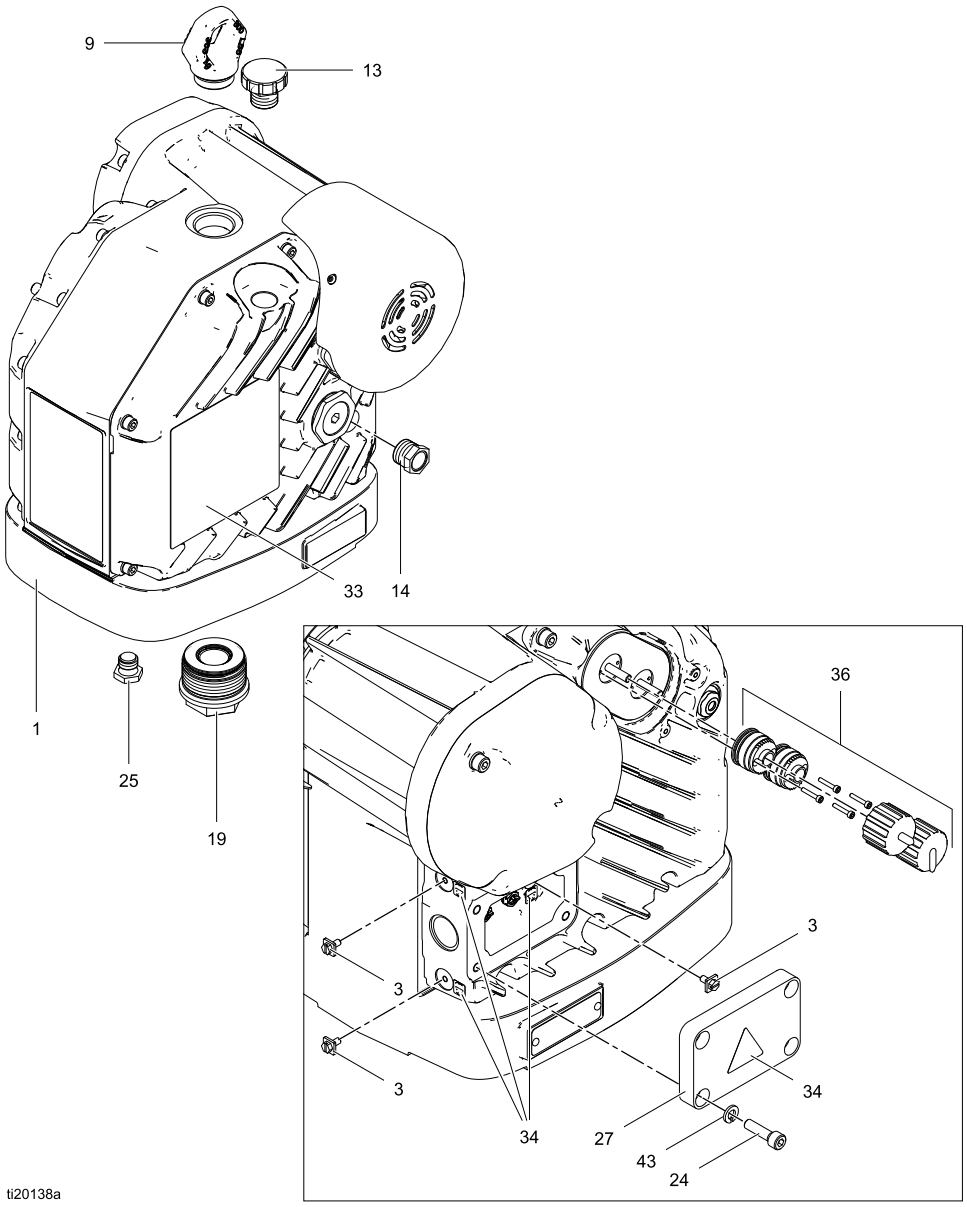


1. Stop the pump at the bottom of its stroke. Shut off and lock out power to the motor.
2. Follow the Pressure Relief Procedure, page 13.
3. Disconnect the lower from the motor, as explained in your separate E-Flo DC pump manual.
4. Drain the oil from the motor. See Change the Oil, page 16.
5. Reinstall the oil drain plug. Torque to 25–30 ft-lb (34–40 N•m).
6. Unscrew the output cartridge (19) from the motor. See Parts, page 20.
7. Install the new output cartridge. Torque to 70–80 ft-lb (95–108 N•m).
8. Fill with oil. See Change the Oil, page 16.
9. Reconnect the lower to the motor.
10. Turn on power and resume operation.

Parts

Basic Motor Assembly

EM0011, Series A, 1 Horsepower Motor
EM0013, Series A, 1 Horsepower Motor, with Region-Specific Approvals
EM0021, Series A, 2 Horsepower Motor
EM0023, Series A, 2 Horsepower Motor, with Region-Specific Approvals



EM0011, Series A, 1 Horsepower Motor

EM0013, Series A, 1 Horsepower Motor, with Region-Specific Approvals

EM0021, Series A, 2 Horsepower Motor

EM0023, Series A, 2 Horsepower Motor, with Region-Specific Approvals

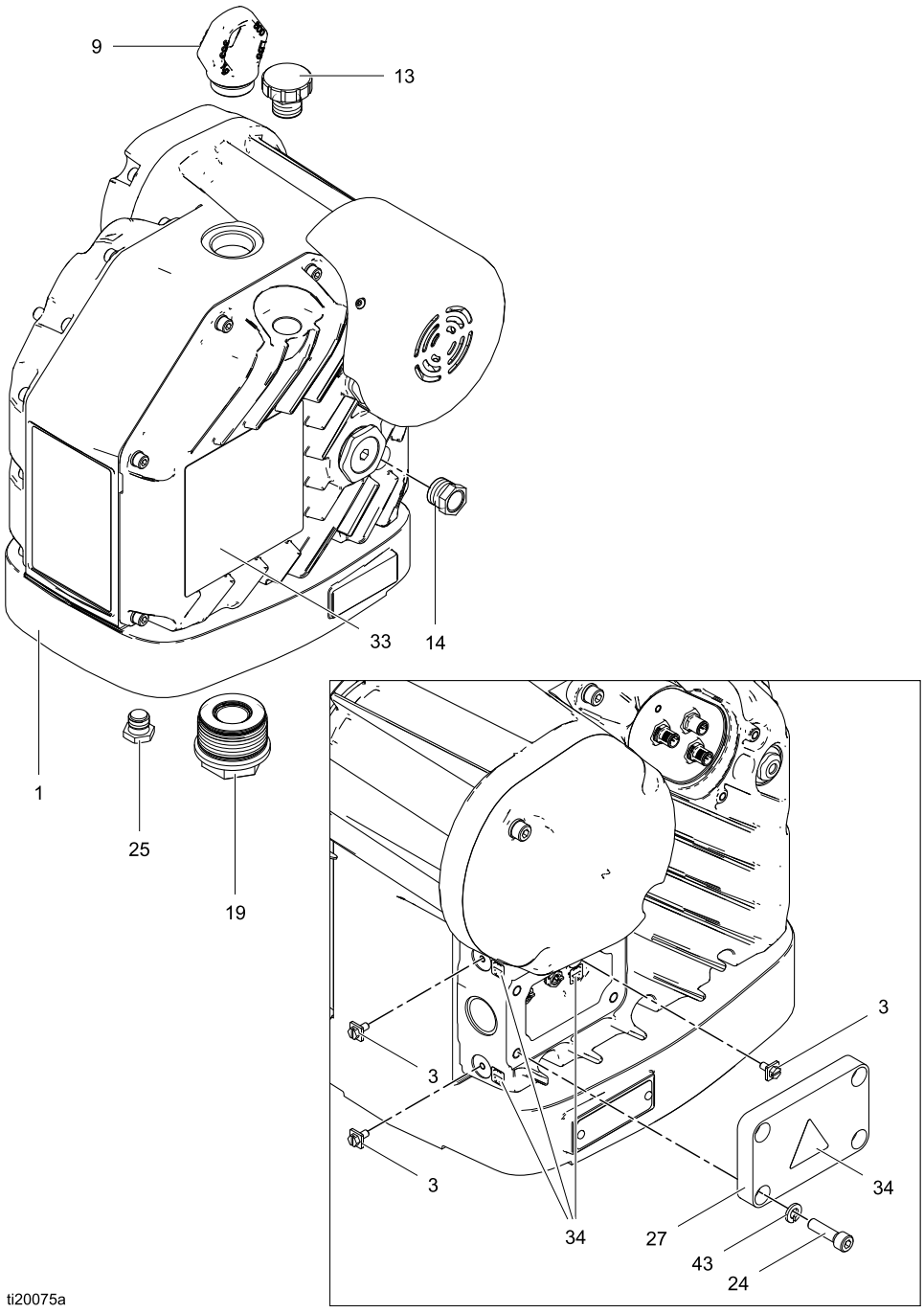
Ref	Part	Description	Qty
1	— — —	HOUSING, motor	1
3	116343	SCREW, ground; M5 x 0.8	3
9	15F931	RING, lift	1
13	15H525	CAP, oil fill	1
14	24E315	SIGHT GLASS	1
19	24K341	CARTRIDGE, output seal	1
24	— — —	SCREW, cap, socket head; M8 x 1.25; 30 mm	4
25	15H432	PLUG, oil drain	1
27	— — —	COVER, electrical compartment	1
33▲	16M130	LABEL, warning (EM0011 and EM0021)	1
	16W360	LABEL, warning (EM0013 and EM0023)	1
34▲	196548	LABEL, warning	1
36	16U113	KIT, knob; kit includes replacement parts for one knob	2
38	16W645	OIL, gear, synthetic; ISO 220 silicone-free; 1 quart (0.95 liter); not shown	2
43	— — —	WASHER, lock, spring; no. 8	4

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

Items marked — — — are not available separately.

Advanced Motor Assembly

EM0012, Series A, 1 Horsepower Motor
EM0014, Series A, 1 Horsepower Motor, with Region-Specific Approvals
EM0022, Series A, 2 Horsepower Motor
EM0024, Series A, 2 Horsepower Motor, with Region-Specific Approvals
EM0025, Series A, 2 Horsepower Motor
EM0026, Series A, 2 Horsepower Motor, with Region-Specific Approvals



EM0012, Series A, 1 Horsepower Motor

EM0014, Series A, 1 Horsepower Motor, with Region-Specific Approvals

EM0022, Series A, 2 Horsepower Motor

EM0024, Series A, 2 Horsepower Motor, with Region-Specific Approvals

EM0025, Series A, 2 Horsepower Motor

EM0026, Series A, 2 Horsepower Motor, with Region-Specific Approvals

Ref	Part	Description	Qty
1	— — —	HOUSING, motor	1
3	116343	SCREW, ground; M5 x 0.8	3
9	15F931	RING, lift	1
13	15H525	CAP, oil fill	1
14	24E315	SIGHT GLASS	1
19	24K341	CARTRIDGE, output seal	1
24	— — —	SCREW, cap, socket head; M8 x 1.25; 30 mm	4
25	15H432	PLUG, oil drain	1
27	— — —	COVER, electrical compartment	1
33▲	16M130	LABEL, warning (EM0012, EM0022, and EM0025)	1
	16W360	LABEL, warning (EM0014, EM0024, and EM0026)	1
34▲	196548	LABEL, warning	1
38	16W645	OIL, gear, synthetic; ISO 220 silicone-free; 1 quart (0.95 liter); not shown	2
43	— — —	WASHER, lock, spring; no. 8	4

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

Items marked — — — are not available separately.

Notes

Repair Kits, Related Manuals, and Accessories

Motor Part No.	Description	Kits	Kit Description
All motors in this manual.	E-Flo DC Motors	24K341	Output Seal Cartridge (19); see Parts, page 20.
		24P816	Shaft Collector Kit; see manual 406998.
		255143	Wall Bracket; see manual 312148.
		16W645	ISO 220 Silicone-Free Synthetic Gear Oil; 1 quart (0.95 liter); order 2
		16U705	Position Sensor; see Position Sensor Replacement, page 32.
		24U938	Encoder; see Encoder Replacement, page 29
		108675	Wiring Post
Models EM00X1, EM00X3	E-Flo DC Basic Motors	16U113	Knob Kit (36); see Parts, page 20. Includes replacement parts for one knob.
		24U934	Electric 1HP Control Board; see Control Board Replacement, page 27
		24U936	Electric 2HP Control Board; see Control Board Replacement, page 27
Models EM0012, EM0014, EM0022, EM0024, EM0025, and EM0026	E-Flo DC Advanced Motors	24P822	Control Module, for Advanced Motors; see manual 3A2527.
		16P911	CAN Cable, 3 ft (1 m)
		16P912	CAN Cable, 25 ft (8 m)
		24P979	Pneumatic Control for Back Pressure Regulator; see manual 332142.
		24R050	Pressure Transducer Kit
		16U729	Start/Stop Switch. Allows pump to be shut off while maintaining power to the control module.
		24U935	Electric 1HP Control Board see Control Board Replacement, page 27
		24U937	Electric 2HP Control Board see Control Board Replacement, page 27
		24U939	Powerboard

Motor Part No.	Description	Kits	Kit Description
All motors in this manual.	Connection kits, to mount an E-Flo DC Motor to an existing pump lower. Kits include tie rods, tie rod nuts, adapter, and coupler.	288203	For 3000 and 4000 cc 4–Ball Lowers
		288204	For Dura-Flo 1800 and 2400 Lowers
		288205	For Dura-Flo 600, 750, 900, and 1200 Lowers
		288206	For Dura-Flo 1000 Lowers
		288207	For Xtreme 145, 180, 220, 250, and 290 Lowers
		288209	For 750, 1000, 1500, and 2000 cc 4–Ball Lowers
		288860	For Xtreme 85 and 115 Lowers

Control Board Replacement Kits 24U934, 24U936, 24U935, 24U937

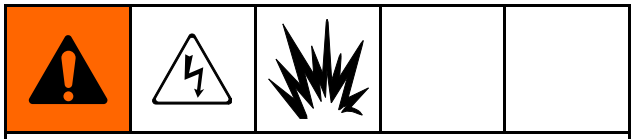
Overview

The main control board assembly manages the operation of the E-Flo DC. It is permanently attached to the electronics cover.

Tools Required

- 6 mm Hex Wrench
- Phillips Screwdriver (#1)
- Torque Wrench (15 ft-lb, 20 Nm)

Replacement Instructions



To avoid electric shock, turn off equipment power and shut off power at main circuit breaker before installing.

NOTICE

To avoid damage to the control board wear grounding strap (Part No. 112190) and ground appropriately.

Prepare Motor

1. Remove power from the motor. Follow appropriate lock-out/tag-out procedures.
2. Follow the Pressure Relief Procedure, page 13.
3. Decouple the pump lower from the motor per the appropriate pump manual.

Disconnect Power Wires

1. See Remove the 4 bolts that hold on the wiring box cover using a 6mm hex wrench. Place bolts in a safe location.
2. Disconnect wires from post and ground screw inside of cover.
3. Remove power cable and/or conduit from electronics cover.

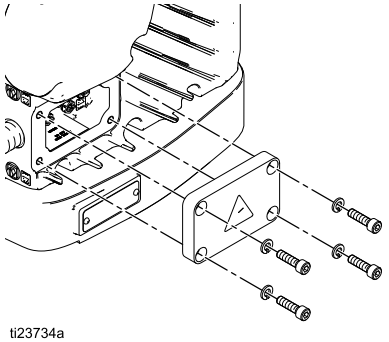
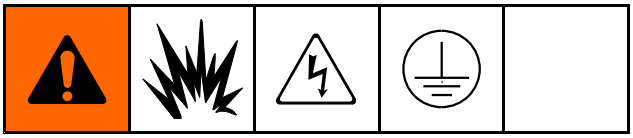


Figure 16 Wiring Box Cover

Remove Electronics Cover



NOTICE

To avoid equipment damage, carefully support the cover when removing the last bolt. Hold the cover horizontally and take care that the wires are not pulled tight.

1. Remove the 12 bolts that hold on the electronics cover using a 6mm hex wrench. Place bolts in a safe location.
2. Support the cover after the bolts are removed to prevent putting excess strain on the wires inside the E-Flo DC.

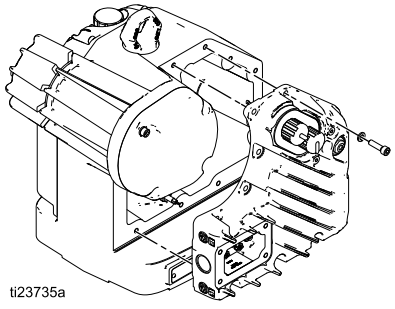


Figure 17 Electronics Cover

Disconnect Control Board

NOTE: The control board is inside the electronics cover. To replace the control board the entire electronics cover must be replaced.

1. To disconnect the control board unplug the position sensor, encoder, temperature sensor, and motor from the control board.
2. Remove wires from clip inside housing.
3. Remove any tie straps that may be present.
4. Set the electronics cover/control board aside.

For advanced models see Disconnect Power Barrier Board, page 35.

Install New Control Board

1. Plug the position sensor, encoder, temperature sensor, and motor into the new control board.
2. Secure loose wires into the clip inside the housing.

For advanced models see Install New Power Barrier Board, page 35.

Reset Dip Switch

To calibrate the unit a dip switch on the control board must be toggled. There are two dip switches located on the upper control board. Reset either dip switch by toggling it to the opposite state. This signals the control board that a replacement part has been installed. The next time the unit is powered it will proceed with an auto-calibration sequence.

NOTE: If you are performing more than one repair procedure the dip switch only needs to be toggled into the opposite state one time.

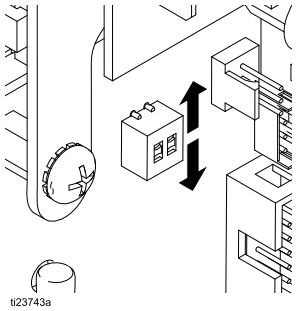
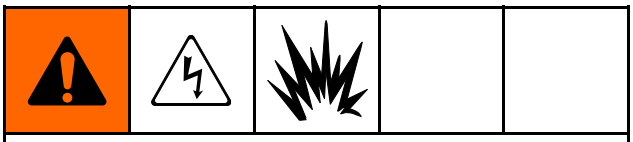


Figure 18 Dip Switch

Reinstall Electronics Cover



Be sure that no wires are pinched between the electronics cover and the motor housing. Pinched wires may damage the control board and will impair explosion-proof safety.

1. Reinstall electronics cover onto center housing.
2. Install the 12 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.
3. Torque the bolts to 15 ft-lb (20 Nm).

Reinstall Wiring Box Cover

1. Connect wires from inside of wiring box. Refer to torque instructions listed on placard inside of the wiring box. Connect power cable and/or conduit to the electronics cover.
2. Reinstall cover onto wiring box.
3. Install the 4 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.
4. Torque the bolts to 15 ft-lb (20 Nm).

Power Unit

1. Apply power to the unit to start the auto-calibration process.
2. The motor output shaft will run up and down over the course of several minutes.
3. Midway through the auto-calibration process the motor output shaft will pause as it moves to the next step.
4. Ensure the auto-calibration process is complete before continuing.

Reattach Pump Lower

1. Jog the output shaft on the pump lower and reconnect the coupling nut.
2. Torque to the proper level per the appropriate pump manual.

Encoder Replacement Kit 24U938

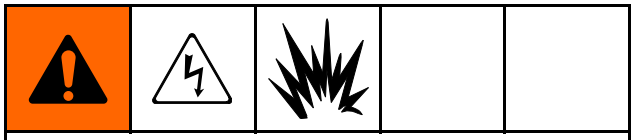
Overview

The encoder is used by the E-Flo DC for two purposes. First, the encoder tells the control board where the motor is in its mechanical rotation and uses that information to properly control the motor torque. Second, it controls stroke length by allowing the control board to count the number of complete motor rotations.

Tools Required

- 6 mm Hex Wrench
- .050 in Hex Wrench
- Phillips Screwdriver (#1)
- Torque Wrench (15 ft-lb, 20 Nm)
- Blue (medium) thread locking compound

Replacement Instructions



To avoid electric shock, turn off equipment power and shut off power at main circuit breaker before installing.

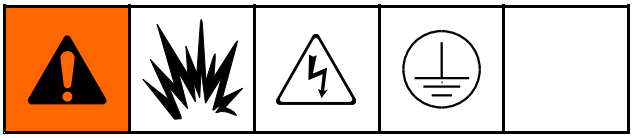
NOTICE

To avoid damage to the control board wear grounding strap (Part No. 112190) and ground appropriately.

Prepare Motor

1. Remove power from the motor. Follow appropriate lock-out/tag-out procedures.
2. Follow the Pressure Relief Procedure, page 13.
3. Decouple the pump lower from the motor per the appropriate pump manual.

Remove Electronics Cover



NOTICE

To avoid equipment damage, carefully support the cover when removing the last bolt. Hold the cover horizontally and take care that the wires are not pulled tight.

1. Remove the 12 bolts that hold on the electronics cover using a 6mm hex wrench. Place bolts in a safe location.
2. Support the cover after the bolts are removed to prevent putting excess strain on the wires inside the E-Flo DC.

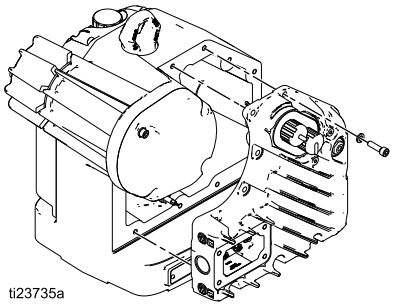
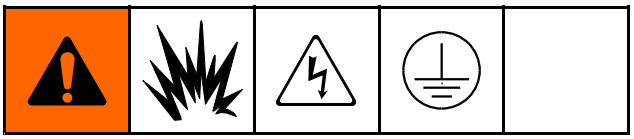


Figure 19 Electronics Cover

Remove Motor Cover



1. Remove the 4 bolts that hold on the motor cover using a 6mm hex wrench. Place bolts in a safe location.
2. Set motor cover aside.

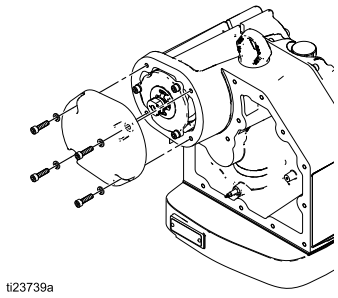


Figure 20 Motor Cover

Remove Encoder

1. Unplug the encoder cable from the control board and the encoder and remove.
2. Loosen the 2 hub set screws (AA) using the included .050” hex wrench.
3. Remove the 2 mounting screws (AC) with a Phillips head screw driver.
4. Pull encoder off of rotor shaft.

NOTE: This procedure only requires the removal of the 2 Phillips head mounting screws. All other bolts should remain in place.

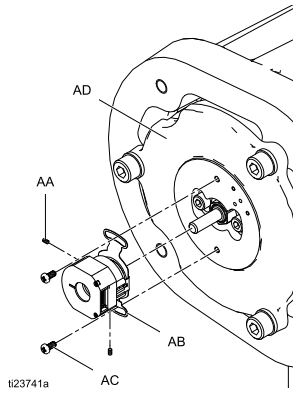


Figure 21 Encoder

AA	Set screws
AB	Encoder mounting flange
AC	Phillips head mounting screws
AD	Motor housing

Install New Encoder

1. Place the encoder connector cable (AE) through the motor housing lower port (AF).

   NOTE: The encoder connector is the smaller of the two connections.

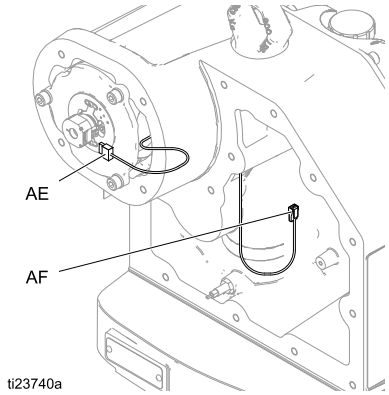


Figure 22 Encoder Cable

AE	Encoder connector cable
AF	Lower port of motor housing

2. Slide the new encoder onto the rotor shaft.
3. Apply a small amount of blue (medium) thread locker to the 2 Phillips head mounting screws (AC) and secure encoder mounting flange (AB) to motor housing (AD).
4. Remove the 2 set screws (AA) from the encoder hub using the included .050” hex wrench.
5. Apply a small amount of blue (medium) thread locker to the set screws (AA) and screw back into the encoder. Tighten hand tight.
6. Plug encoder cable into the encoder and the control board.

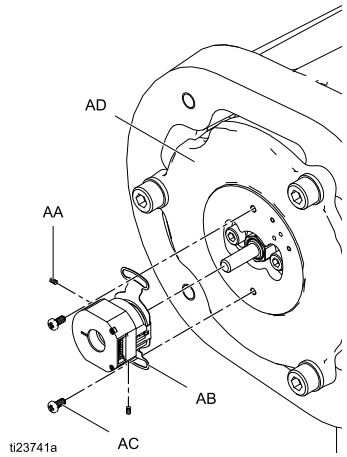


Figure 23 Encoder

AA	Set screws
AB	Encoder mounting flange
AC	Phillips head mounting screws
AD	Motor housing

Reset Dip Switch

To calibrate the unit a dip switch on the control board must be toggled. There are two dip switches located on the upper control board. Reset either dip switch by toggling it to the opposite state. This signals the control board that a replacement part has been installed. The next time the unit is powered it will proceed with an auto-calibration sequence.

NOTE: If you are performing more than one repair procedure the dip switch only needs to be toggled into the opposite state one time.

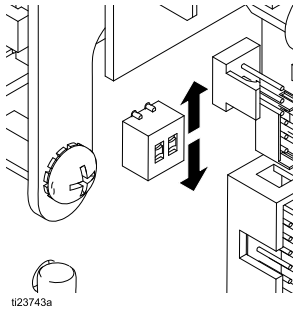
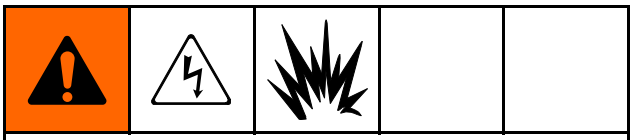


Figure 24 Dip Switch

Reinstall Electronics Cover

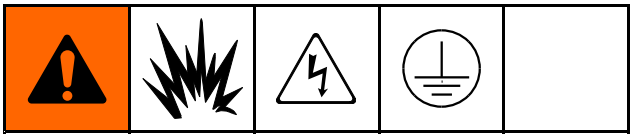


Be sure that no wires are pinched between the electronics cover and the motor housing. Pinched wires may damage the control board and will impair explosion-proof safety.

1. Reinstall electronics cover onto center housing.
2. Install the 12 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.
3. Torque the bolts to 15 ft-lb (20 Nm).

Reinstall Motor Cover



1. Reinstall motor cover onto motor housing.
2. Install the 4 bolts that hold on the motor cover using a 6mm hex wrench. Ensure the lock washers are still in place.
3. Torque the bolts to 15 ft-lb (20 Nm).

Power Unit

1. Apply power to the unit to start the auto-calibration process.
2. The motor output shaft will run up and down over the course of several minutes.
3. Midway through the auto-calibration process the motor output shaft will pause as it moves to the next step.
4. Ensure the auto-calibration process is complete before continuing.

Reattach Pump Lower

1. Jog the output shaft on the pump lower and reconnect the coupling nut.
2. Torque to the proper level per the appropriate pump manual.

Position Sensor Replacement Kit 16U705

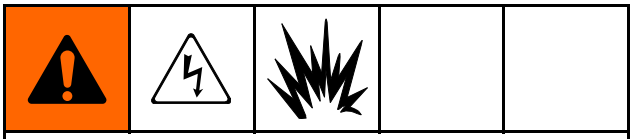
Overview

The position sensor is used by the E-Flo DC to determine where the motor is in the stroke.

Tools Required

- 6 mm Hex Wrenches
- 13 mm Open-Ended Wrench
- 6 mm Open-Ended Wrench
- Phillips Screwdriver (#2)
- Torque Wrench (15 ft-lb, 20 Nm)

Replacement Instructions



To avoid electric shock, turn off equipment power and shut off power at main circuit breaker before installing.

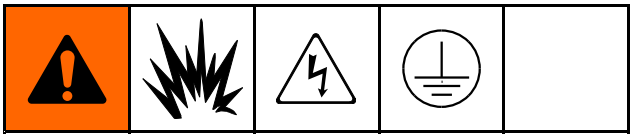
NOTICE

To avoid damage to the control board wear grounding strap (Part No. 112190) and ground appropriately.

Prepare Motor

1. Remove power from the motor. Follow appropriate lock-out/tag-out procedures.
2. Follow the Pressure Relief Procedure, page 13.
3. Decouple the pump lower from the motor per the appropriate pump manual.

Remove Electronics Cover



NOTICE

To avoid equipment damage, carefully support the cover when removing the last bolt. Hold the cover horizontally and take care that the wires are not pulled tight.

1. Remove the 12 bolts that hold on the electronics cover using a 6mm hex wrench. Place bolts in a safe location.
2. Support the cover after the bolts are removed to prevent putting excess strain on the wires inside the E-Flo DC.

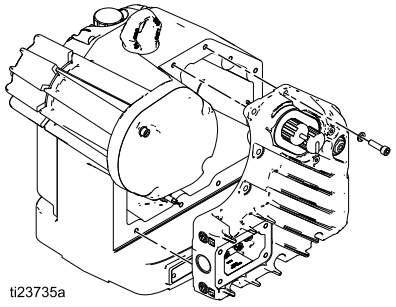


Figure 25 Electronics Cover

Remove Position Sensor

1. Unplug the position sensor from the control board.
2. Unscrew the shield ground (AT) using a Phillips screwdriver.
3. Loosen the position sensor jam nut (AS) using a 13 mm wrench.
4. Unscrew the position sensor (AR) from the center housing using a 6 mm open ended wrench.

   NOTE: Allow wires to rotate with position sensor to prevent twisting.

Install New Position Sensor

1. Carefully screw the replacement position sensor into the center housing.

   NOTE: Be careful not to damage the wires. The wires will have to be rotated while the position sensor is installed to prevent them from being twisted.

2. Use the 6 mm wrench to complete the installation of the position sensor. Be careful not to use excessive torque. Stop once the position sensor bottoms out in the bore.

   NOTE: Do not over tighten the position sensor. Damage to the position sensor may result.

3. Tighten the jam nut on the position sensor finger tight.

   NOTE: Do NOT use a wrench to tighten the jam nut. Damage to the position sensor may result.

4. Install shield ground wire using a Phillips screw driver.

5. Plug the position sensor into the control board.

Reset Dip Switch

To calibrate the unit a dip switch on the control board must be toggled. There are two dip switches located on the upper control board. Reset either dip switch by toggling it to the opposite state. This signals the control board that a replacement part has been installed. The next time the unit is powered it will proceed with an auto-calibration sequence.

NOTE: If you are performing more than one repair procedure the dip switch only needs to be toggled into the opposite state one time.

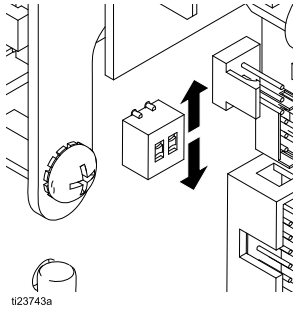
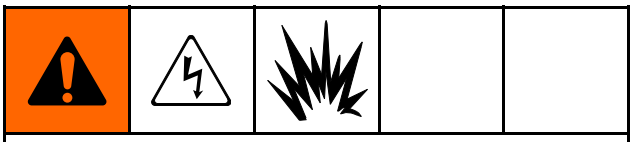


Figure 26 Dip Switch

Reinstall Electronics Cover



Be sure that no wires are pinched between the electronics cover and the motor housing. Pinched wires may damage the control board and will impair explosion-proof safety.

1. Reinstall electronics cover onto center housing.
2. Install the 12 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.

3. Torque the bolts to 15 ft-lb (20 Nm).

Power Unit

1. Apply power to the unit to start the auto-calibration process.
2. The motor output shaft will run up and down over the course of several minutes.
3. Midway through the auto-calibration process the motor output shaft will pause as it moves to the next step.
4. Ensure the auto-calibration process is complete before continuing.

Reattach Pump Lower

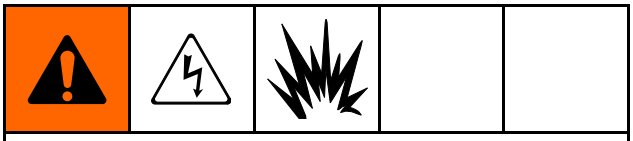
1. Jog the output shaft on the pump lower and reconnect the coupling nut.
2. Torque to the proper level per the appropriate pump manual.

Advanced Power Board Replacement Kit 24U939

Tools Required

- 6 mm Hex Wrenches
- 1/4” Nut Driver
- 5 mm Hex Wrench
- Phillips Screwdriver (#2)
- Torque Wrench (15 ft-lb, 20 Nm)

Replacement Instructions



To avoid electric shock, turn off equipment power and shut off power at main circuit breaker before installing.

NOTICE

To avoid damage to the control board wear grounding strap (Part No. 112190) and ground appropriately.

Prepare Motor

1. Remove power from the motor. Follow appropriate lock-out/tag-out procedures.
2. Follow the Pressure Relief Procedure, page 13.
3. Decouple the pump lower from the motor per the appropriate pump manual.

Disconnect Power Wires

1. See Remove the 4 bolts that hold on the wiring box cover using a 6mm hex wrench. Place bolts in a safe location.
2. Disconnect wires from post and ground screw inside of cover.
3. Remove power cable and/or conduit from electronics cover.

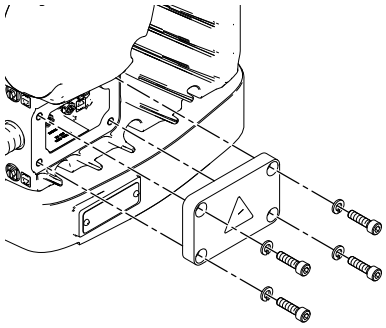


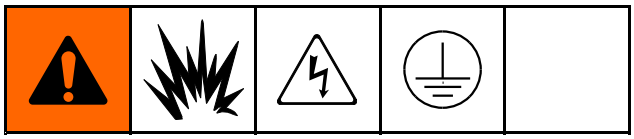
Figure 27 Wiring Box Cover

Remove Control Module Bracket

If the control module is bracket mounted to the electronics cover it must be removed prior to removing the electronics cover.

1. Unsnap the control module from the bracket and disconnect the cable from the electronics cover, set control module aside.
2. Remove control module bracket from the electronics cover, set bracket and hardware aside.

Remove Electronics Cover



NOTICE

To avoid equipment damage, carefully support the cover when removing the last bolt. Hold the cover horizontally and take care that the wires are not pulled tight.

1. Remove the 12 bolts that hold on the electronics cover using a 6mm hex wrench. Place bolts in a safe location.
2. Support the cover after the bolts are removed to prevent putting excess strain on the wires inside the E-Flo DC.

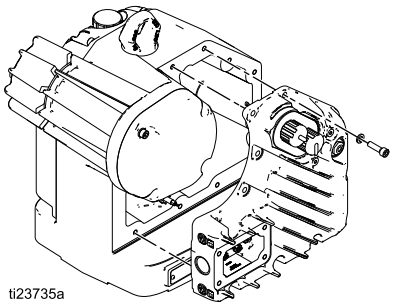


Figure 28 Electronics Cover

Disconnect Power Barrier Board

NOTICE

The CAN bus on the power barrier board is connected to the control board through a partition inside the motor. To avoid equipment damage, hold electronics cover in place until the CAN bus cable is disconnected. Hold the cover horizontally and take care that the wires are not pulled tight.

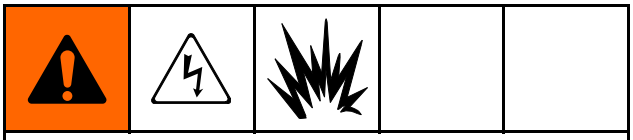
1. Disconnect barrier board power cable from the control board.
2. Remove the 4 screws (AK) holding the partition (AL) and power cable bracket (AJ) in place, set aside.
3. Remove any tie straps that are present.
4. Insert a small hex key into the lower left corner of the partition and pull out.
5. Remove tie strap connecting the CAN bus wire to the power barrier board (AN).
6. Use 1/4” nut driver to remove the 4 stand offs (AM) from the corners of the power barrier board, set aside.
7. Use a 5mm hex wrench to remove the 2 socket headed cap screws (AP) from the power barrier board, set aside.
8. Remove the power barrier board (AN) from the unit.

Install New Power Barrier Board

1. Insert the tie strap through the back of the power barrier board.
2. Put new power barrier board in place and secure using reserved screws. Tighten standoffs hand tight. Torque socket head cap screws to 15 ft-lb (20 Nm).

   NOTE: Put all six screws in place before tightening. The standoffs should be tightened before the socket head cap screws.
3. Plug the CAN bus power into the power barrier board.
4. Tighten the tie strap around the wires to secure them to the board.
5. Place partition back into place. Make certain the notch for the wires is on the lower left side of the partition and the wires are not being crushed.
6. Insert bottom screws into the partition and tighten.
7. Place power connect bracket into place and secure with two screws.
8. Reconnect motor, temperature, reed switch, encoder, and barrier board power wires to the control board.

Reinstall Electronics Cover



Be sure that no wires are pinched between the electronics cover and the motor housing. Pinched wires may damage the control board and will impair explosion-proof safety.

1. Reinstall electronics cover onto center housing.
2. Install the 12 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.
3. Torque the bolts to 15 ft-lb (20 Nm).

Reinstall Wiring Box Cover

1. Connect wires from inside of wiring box. Refer to torque instructions listed on placard inside of the wiring box. Connect power cable and/or conduit to the electronics cover.
2. Reinstall cover onto wiring box.
3. Install the 4 bolts using a 6 mm hex wrench.

   NOTE: Ensure the lock washers are still in place.
4. Torque the bolts to 15 ft-lb (20 Nm).

Attach Control Module Bracket

1. Connect the control module cable to the electronics cover.
2. Reattach the control module mounting bracket onto the electronics cover.
3. Snap the control module into place on the bracket.

Power Unit

1. Apply power to the unit to start the auto-calibration process.
2. The motor output shaft will run up and down over the course of several minutes.
3. Midway through the auto-calibration process the motor output shaft will pause as it moves to the next step.
4. Ensure the auto-calibration process is complete before continuing.

Reattach Pump Lower

1. Jog the output shaft on the pump lower and reconnect the coupling nut.
2. Torque to the proper level per the appropriate pump manual.

Appendix A - System Control Drawing 24N637

NOTES FOR FIG. 16 AND 17:

1. The non-intrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than Um = 250 Vrms or dc unless it has been determined that the voltage has been adequately isolated.
2. All motors must be bonded to the same high integrity equipotential system.
3. Do not remove any cover until power has been removed.
4. Installation should be in accordance with ANSI/ISA RP12.06.01, installation of intrinsically safe systems for hazardous (classified) locations, and the National Electrical Code (ANSI/NFPA 70).
5. Installation in Canada should be in accordance with the Canadian Electrical Code, CSA C22.1, Part 1, Appendix F.
6. Reserved for future use.
7. Between one and eight motors may be connected in series. The motors are connected with a CAN cable (16P911 or 16P912). The side of the cable with the red marking is connected to Port 1 of one motor and the unmarked side of the cable is connected to Port 2 of the next motor.
8. The first motor in the series (the one with no CAN cable on Port 2) is installed with the power jumper 24N910 connected to Port 2 and Port 3.
9. The “last” motor in the series is connected to either an IS apparatus in the hazardous location or an associated IS apparatus in the non-hazardous location. The side of the CAN cable with the red marking is connected to Port 1 of the last motor and the unmarked side of the cable is connected to the IS or associated IS apparatus.
10. The output entity parameters given for Pins 1 and 4 in each of Ports 1 and 2 are the total current and power available to both pins added together. The current on Pin 1 and Pin 4 added together will not exceed the listed Io, and the power output from Pin 1 and Pin 4 added together will not exceed the listed Po.

WARNING: Substitution of components may impair intrinsic safety.

ADVERTISSEMENT: La substitution de composants peut compromettre la securite intrinseque.

Table 2 . Calculation Procedures

Zones
Uo ≤ Ui
Io ≤ Ii
Po ≤ Pi
Co ≥ Ci + Ccable
Lo ≥ Li + Lcable
Lo / Ro ≥ Li / Ri

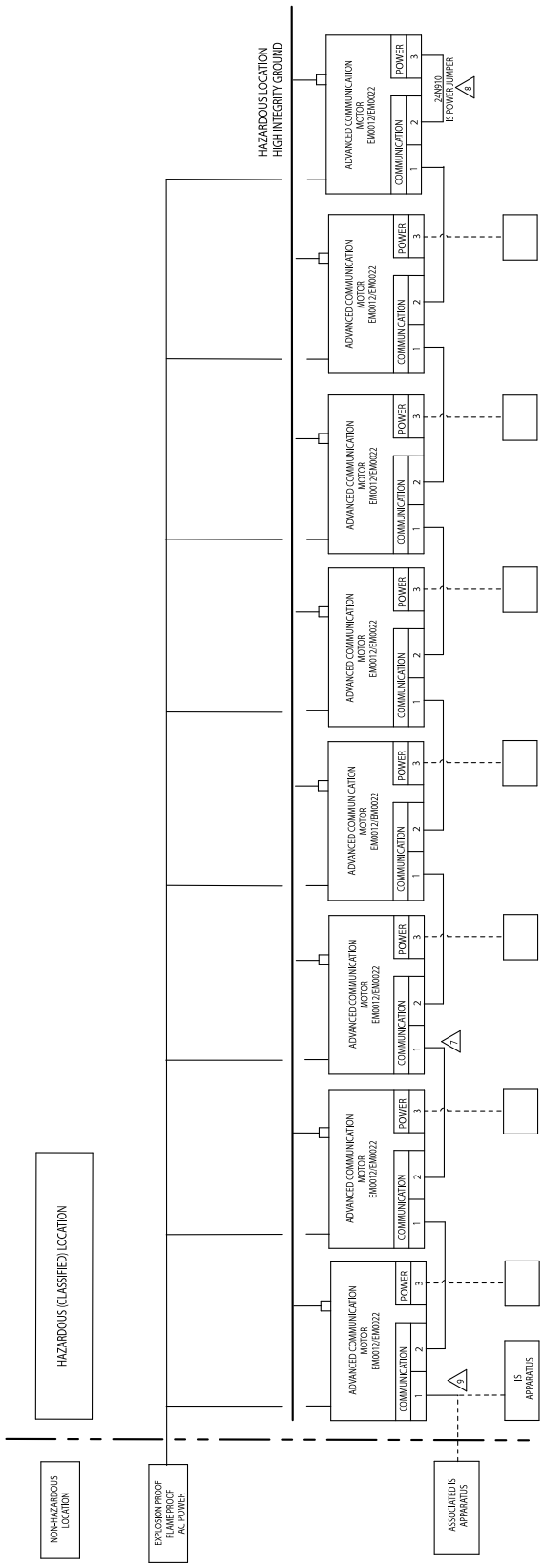


Figure 29 System Control Drawing 24N637, Sheet 1

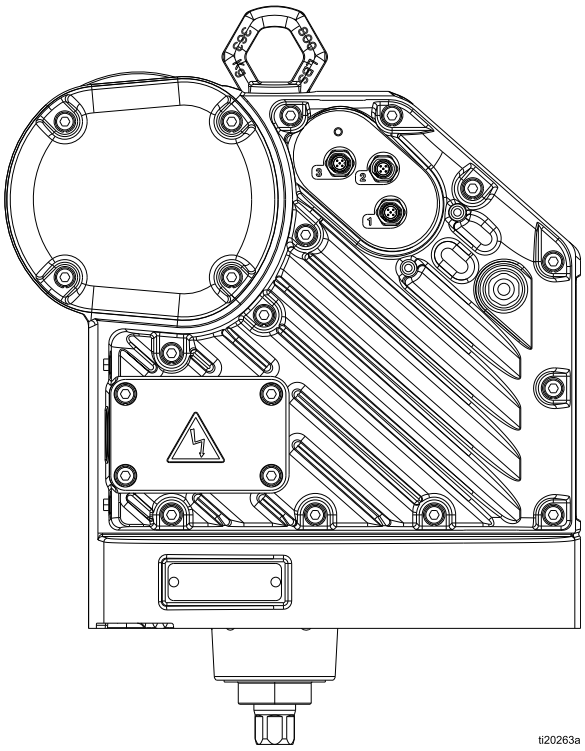


Figure 30 System Control Drawing 24N637, Sheet 2

Table 3 . Port 3: Power Barrier Output Parameters

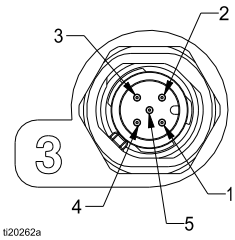
Power Barrier Output Parameters							
Port 3: Male M12 5 Pin "A" Key 	**Pin**	**Units**	**Voc**	**Isc**	**Pt**	**La**	**Ca**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	Not Connected				
	2	Power	17.9	646	2891	681	7.7
	3	IS Ground Return	—	—	—	—	—
	4	CAN Data High	Not Connected				
	5	Shield	—	—	—	—	—

Table 4 . Ports 1 and 2: CAN Data/Power In and Out Entity Parameters

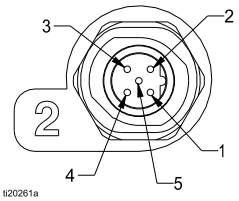
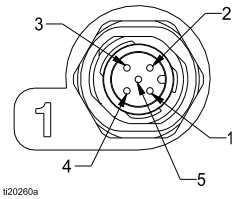
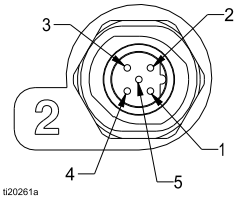
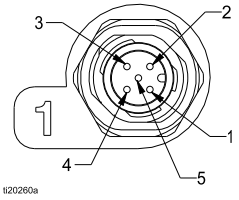
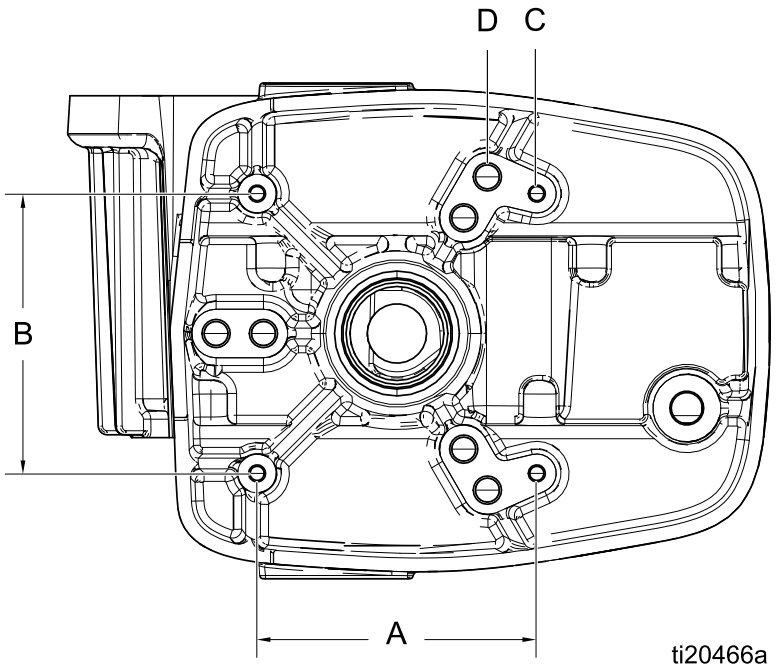
CAN Data High/Low Input Loads							
Port 2: Male M12 5 Pin "B" Key  **Port 1: Male M12 5 Pin "A" Key** 	**Pin**	**Units**	**Vmax**	**Imax**	**Pi**	**Li**	**Ci**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	See Table 5 for Data based on the Number of Motors				
	2	VIN Power	17.9	725	2900	128	0
	3	Signal Ground	—	—	—	—	—
	4	CAN Data High	See Table 5 for Data based on the Number of Motors				
	5	Shield	—	—	—	—	—
CAN Data High/Low Output Barriers							
Port 2: Male M12 5 Pin "B" Key  **Port 1: Male M12 5 Pin "A" Key** 	**Pin**	**Units**	**Voc**	**Isc**	**Pt**	**La**	**Ca**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	See Table 5 for Data based on the Number of Motors				
	2	VIN Power	17.9	646	2891	681	7.7
	3	Signal Ground	—	—	—	—	—
	4	CAN Data High	See Table 5 for Data based on the Number of Motors				
	5	Shield	—	—	—	—	—

Table 5 . Ports 1 and 2, Pins 1 and 4: CAN Data High and Low (applies to all CAN data pins shorted together or to any individual pin; see Note 10 on page 26)

CAN Data High/Low Input Loads						
Number of Motors	Units	Vmax	Imax	Pi	Li	Ci
		Vmax	mA	mW	µH	µF
1		6	700	900	67	0.2
2		6	700	900	67	0.4
3		6	700	900	67	0.6
4		6	700	900	67	0.8
5		6	700	900	67	1.0
6		6	700	900	67	1.2
7		6	700	900	67	1.4
8		6	700	900	67	1.6
CAN Data High/Low Output Barriers						
Number of Motors	Units	Voc	Isc	Pt	La	Ca
		Vmax	mA	mW	mH	µF
1		4.94	102	79	27.3	1000
2		4.94	179	158	8.88	1000
3		4.94	246	237	4.70	1000
4		4.94	305	316	3.06	1000
5		4.94	358	395	2.22	1000
6		4.94	407	474	1.72	1000
7		4.94	452	553	1.39	1000
8		4.94	494	632	1.17	1000

Mounting Hole Pattern



A	B	C	D
6.186 in. (157 mm)	6.186 in. (157 mm)	Four 3/8–16 Mounting Holes	Six 5/8–11 Tie Rod Holes: • 8 in. (203 mm) x 120° bolt circle OR • 5.9 in. (150 mm) x 120° bolt circle

Technical Data

E-Flo DC Motors	U.S.	Metric
Input voltage/Power:		
Models EM0011, EM0012, EM0013, and EM0014	100–130/ 200–240 VAC single phase, 50/60 Hz, 1.4 kVA	
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	200–240 VAC, single phase, 50/60 Hz, 2.9 kVA	
Maximum potential fluid pressure:		
Models EM0011, EM0012, EM0013, and EM0014	218000/v (volume of lower in cc) = psi	1500/v (volume of lower in cc) = bar
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	436000/v (volume of lower in cc) = psi	3000/v (volume of lower in cc) = bar
Maximum continuous cycle rate	20 cpm	
Maximum force:		
Models EM0011, EM0012, EM0013, and EM0014	1400 lbf	6227 N
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	2800 lbf	12455 N
Power inlet port size	3/4–14 npt(f)	
Ambient temperature range	32–104°F	0–40°C
Sound data	Less than 70 dB(A)	
Oil capacity	1.5 quarts	1.4 liters
Oil specification	Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil	
Weight	99 lb	45 kg

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

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